Chapter One

LONG-TERM TRENDS AND THE FUTURE SECURITY ENVIRONMENT IN ASIA

The influences that affect the future security environment in Asia, as elsewhere, are numerous and, at least at a broad and general level, familiar. These influences include political, social, technological, historical, and ethnic elements, as well as economic and military ones. What are not well-known, and indeed may be unfathomable, are the relative weight that should be applied to each of these myriad influences and the strength of the interactions among them. Even in retrospect, it is often exceedingly difficult to be precise about the relative weights or the interactions among the forces that were involved in shaping the security environment. For example, it is incontestable that the dissolution of the Soviet Union has had a profound influence on the current, as well as the future, global security environment. Yet, four years after the fact, it remains quite unclear how much of the explanation for this defining event should be attributed to economic or to military or to political influences, to internal or external ones, and to interactions among all of these.

The work summarized in this report focuses on several narrower questions that relate to, but do not directly address, these broader issues. In this work, we assume that the relative economic and military levels of the principal national economies and national military establishments are among the influences that will significantly affect the future security environment in Asia. Proceeding from this assumption, we focus on four salient, highly aggregate indicators—*gross domestic product (GDP), per-capita GDP, military spending,* and *military capital stocks*—and track their trends from 1994 through 2015. While these are not the only factors affecting the future Asian

security environment, they are among the important ones. GDP and its growth are admittedly gross, but plausible, indicators of the relative size of the national economies and of changes therein. Per-capita GDP is suggestive of prevailing living standards in the region, and of disparities among the regions. Military spending and military capital are relevant, if only partial, indicators of military capabilities and (perhaps) intentions. For example, the recent Department of Defense assessment of U.S. security strategy in the Asia-Pacific region observes:

> China's published defense budget figure has doubled in the past five years, with real growth—adjusted for inflation—estimated at about 40 percent. This figure probably does not encompass all of China's defense expenditures .... Absent a better understanding of China's plans, capabilities and intentions, other Asian nations may feel a need to respond to China's growing military power. (Department of Defense, 1995).

This assessment is also noteworthy because it highlights one of the ways in which developments and policies in some countries may significantly affect developments in other countries in the region.

In sum, estimates of these four indicators suggest some of the principal capabilities and constraints that will condition the future Asian security environment. Toward the end of the report, we will draw from the estimates several implications and conclusions bearing on the future security environment in Asia.

Our estimates build on, update, and expand upon previous RAND work that applied a similar methodology to estimating these same key indicators for many of the same countries.[1] The previous estimates extended from 1950 to 2010, while our new estimates start from 1994, drawing from and, in some instances (e.g., for China and Korea), substantially modifying the previous estimates. These modifications include several changes in basic assumptions underlying the calculations: For example, the previous trend estimates covered South Korea alone, the present estimates cover a unified South and North Korea; the previous estimates proceeded from a single scenario for China's development, the present estimates adopt two differing scenarios; the previous estimates used purchasing-power-parity (ppp) dollar conversion rates from the early 1980s, while the present estimates use more recent ppp conversion rates.

[1]See Wolf et al, 1989. See also Hildebrandt, unpublished.

The calculations reported here cover estimates of these four indicators for the United States, China, Japan, Korea, Taiwan, and India.[2] In reporting our results, we faced a choice between focusing successively on each country, or instead on each of the four functional categories—GDP, per-capita GDP, military spending, and military capital—for the six countries. We have chosen the second option on the premise that comparisons among the countries would enhance the value of the results, and these comparisons are highlighted in each of the four categories. However, the appendix to the report adopts the first option, focusing instead on each country as the unit of analysis and elaborating the data, assumptions, judgments, and detailed calculations made for each country.

The framework for these estimates ignores the possibility of such major exogenous events as serious military conflicts, protracted and severe protectionism, or an oil crisis, as well as the potential effects of trends in one country (e.g., China) on the policies and trends in others. For these and other reasons elaborated in the report, the estimates should be interpreted and used with caution.

Chapter Two summarizes our principal empirical estimates for GDP, per-capita GDP, military spending, and military capital stocks, respectively. Chapter Three then suggests some general inferences and conclusions from the empirical work with respect to its bearing on the future security environment. The report's appendix describes the methodology followed in the empirical work, the reasons for using ppp conversion rates in the calculations, and the data sources, key assumptions, and judgments affecting the estimates for each country. In brief, the appendix explains the aggregate Cobb-Douglas-Solow (CDS) production function and the basis for its use in the calculations; the hierarchic linking of the CDS results to successive estimation of per-capita GDP, military spending, and

[2]Selection of these countries was principally based on their relevance in other related and continuing work in the Department of Defense on the future security environment. Subsequent work will report on the corresponding estimates for Russia, Germany, and Indonesia.

military capital; and the reasons for certain key assumptions (e.g., concerning rates of expected productivity growth in each country) that figure prominently in the calculations.

PRINCIPAL RESULTS

Unless otherwise indicated, all of the calculations made in this work and cited below are presented in 1994 dollars calculated on the basis of purchasing power parity (ppp) exchange rates between the national currencies of the countries concerned and the U.S. dollar, as estimated in the Penn World Tables.[1] These exchange rates show the relative capacity of each country's currency to buy the goods and services produced in that country if these goods and services are valued at prices corresponding to those prevailing in the United States.

There are advantages and disadvantages in using ppp exchange rates for purposes of international comparisons, as there are advantages and disadvantages in using nominal exchange rates for making such comparisons. These points are discussed in the appendix, which deals with methodology. The work summarized in this report is based on the judgment that ppp exchange rates are preferable for making baseline estimates of the relative magnitudes of the aggregate indicators with which we are concerned. Of course, use of nominal exchange rates would drastically—and, in our judgment, misleadingly—alter our results: for example, raising substantially the level of Japan's GDP and severely reducing that of China.

All the GDP growth rates referred to below have been *derived from* the model and methodology discussed in the appendix.

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[1]Summers and Heston, 1991. In some cases, e.g., China, the Mark 5 estimates have been updated by later Penn World Table estimates.

GROSS DOMESTIC PRODUCT

According to our baseline calculations, the U.S. GDP is currently approximately $6.7 trillion dollars. The GDP of Japan ($2.6 trillion) is about 40 percent as large as that of the United States, while China's current GDP is appreciably larger than that of Japan, and nearly three-quarters the size of the U.S. GDP.

Over the next two decades to 2015, the ratio between the GDPs of the Japanese and U.S. economies changes only slightly, from 39 percent to 42 percent, because Japan's average annual growth rate over this period is estimated at 2.6 percent versus 2.2 percent for the United States.

In calculating China's GDP, we use two different scenarios: (1) a "stable-growth" scenario, in which capital formation and factor productivity are higher (although still well below their actual levels in recent years), resulting in an average annual growth rate of 4.9 percent over the 1994–2015 period, and (2) a "disrupted-growth" scenario, in which turmoil and disruption are assumed to accompany a possible leadership succession crisis, and in which some degree of regional fragmentation ensues. The result is to lower the rate of capital formation and factor productivity growth, yielding an average annual GDP growth of 3 percent over the period. The two scenarios suggest, without exhausting, the numerous uncertainties surrounding China's future and our estimates of its economic and military trends. These uncertainties warrant particular caution in interpreting the China estimates and making inferences from them.

In both of the China scenarios, the ppp exchange rates that we use are at the high end of rates used by others—for example, the ppp rates used in some World Bank calculations are about half the rates we use. While recognizing the imprecision of all these rates, the reasons that seem to us to justify the ones used in this study are explained in some detail in the appendix.

In the disrupted-growth scenario, China's GDP reaches a level of $9 trillion by 2015, which is approximately 85 percent of that of the United States at that time ($10.7 trillion). In the stable-growth scenario, China's GDP by 2015 reaches a level of $13.6 trillion—approximately 27 percent above that of the United States in that year.

GDP estimates for Korea are calculated according to three different scenarios, each involving reunification of the peninsula in 1995, an arbitrary and admittedly unrealistic assumption that is made to permit focusing on the post-reunification growth trajectories in the three cases. If reunification occurs at a (more realistic) later date, we expect that the growth trajectories associated with the three differing scenarios will still ensue, even though their starting point would differ from that posited in our calculations. The three scenarios proceed from differing assumptions about the process through which reunification is accomplished: (1) a "soft-landing" scenario, which implies a peaceful, stable, and mutually accommodating unification process, in which nondistorting macroeconomic policies are pursued; (2) reunification accomplished along lines of the German experience in 1990, in which macroeconomic policies introduced distortions in the relationships between wages, productivity, and prices; and (3) reunification by war, followed by benign, nondistorting economic policies. In the second scenario, economic integration between the South and the North occurs through policies that raise wages in the North at a faster pace than the market will bear, resulting in transitional unemployment and higher costs imposed on the South.

In the third scenario, the war results in a South Korean victory, with half of the civil as well as military capital destroyed in both South and North Korea. As a result, GDP in this scenario declines in 1996 by 17 percent, compared with that in the soft-landing scenario. By 2005, the growth path of the war scenario converges with that of the other two scenarios.[2] These three scenarios, and especially the 1995 time period in which reunification is assumed to occur, are heuristic artifacts intended to illustrate some of the relevant possibilities. Although the trajectories of GDP growth that unfold in the three scenarios are somewhat different from one another, by 2015 the *levels* of GDP in a unified Korea are nearly identical in the three scenarios. Starting from the 1994 level of Korea's GDP of 404 billion in 1994 dollars, representing about 16 percent of Japan's current GDP, a re-

[2]By way of comparison, World War II resulted in GDP reductions in Germany and Japan of about 12 percent and 25 percent, respectively. After the war, convergence with prewar growth trends occurred in about 10 years in Germany and 15 years in Japan. See Gordon, 1993.

unified Korea's GDP in all three scenarios reaches by 2015 approximately $2 trillion, about 45 percent of the Japanese GDP in that year.

Taiwan's GDP, starting just below $300 billion in 1994, rises by 2015 to approximately $861 billion, at which time its GDP represents nearly 10 percent of China's GDP in the disrupted-growth scenario, but only 6 percent of China's GDP in the stable-growth scenario.

India's economy maintains a steady and high growth rate, averaging 5.5 percent annually over the next two decades, rising from a level of $1.2 trillion in 1994 to $3.7 trillion in 2015, representing an increase in relative size from about 46 percent of the GDP of Japan in 1994 to approximately 82 percent by 2015. These estimates are predicated on the assumption that India continues its progress with economic liberalization and a relatively reduced state sector.

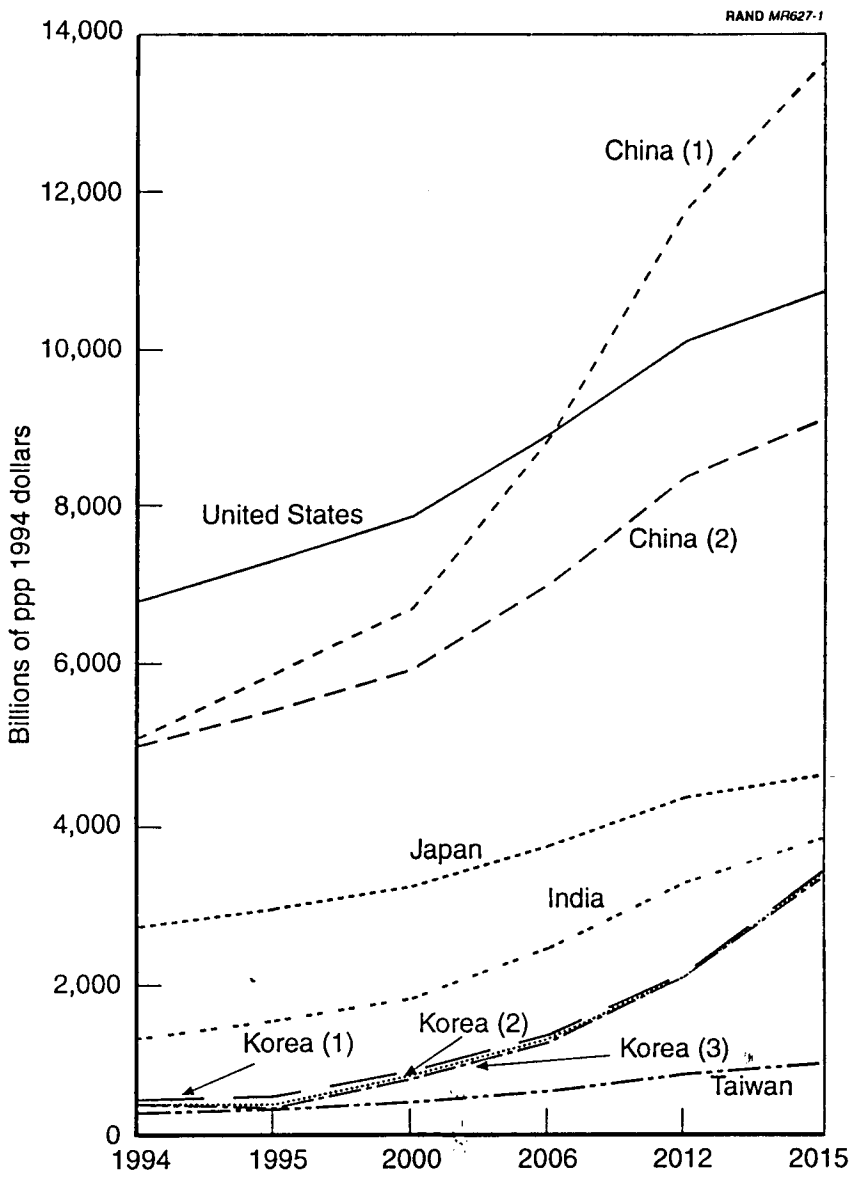
The GDP forecasts for the six countries and the several scenarios are summarized in Table 1 and Figure 1.

Table 1

Gross Domestic (National) Products of Selected Countries 1994–2015

Country/Year	1994	2000	2006	2015	Average Annual Growth Rates,[a] 1994–2015 (%)
	(in billions of ppp 1994 dollars)				
United States	6,704	7,791	8,852	10,673	2.2
Japan	2,593	3,114	3,642	4,509	2.6
China (1) stable-growth	4,950	6,602	8,808	13,569	4.9
China (2) disrupted-growth	4,859	5,802	6,928	9,039	3.0
Korea (1) soft-landing reunification	409	787	1,221	2,024	7.9
Korea (2) German-case reunification	409	776	1,216	2,021	7.9
Korea (3) war reunification	409	726	1,180	2,001	7.3
Taiwan	285	370	541	861	5.4
India	1,193	1,675	2,324	3,693	5.5

[a]These rates have been averaged over the entire period from 1994 through 2015. The estimated rates vary for different intervals over the 21-year period.



NOTE: For the relatively small differences among the three Korean contingencies, see Table 1.

Figure 1—Gross Domestic (National) Products of Selected Countries, 1994–2015

PER-CAPITA GDP

Our estimates for per-capita GDP show, not surprisingly, a strikingly different picture of the relative parities among the six countries from that conveyed by the aggregate GDP figures. Currently, Japan's per-capita GDP is about 20 percent below that of the United States ($21 thousand versus $26 thousand). By 2015, the per-capita GDPs of the two countries are approximately equal. Also by that date, the per-capita GDPs of Korea and Taiwan reach the same level (about $35 thousand) as those attained by the United States and Japan.

China's per-capita GDP, about $4,000 in 1994, is about 20 percent of the per-capita GDP of Japan. By 2015, its per-capita GDP reaches about $10 thousand in the stable-growth scenario, nearly 30 percent of that of Japan. In the disrupted-growth scenario, China's per-capita GDP in 2015 remains about one-fifth of the level in Japan—the same proportion as in 1994.

India's per-capita GDP in 2015 reaches a level of about 70 percent of that of China's in 1994. The ratio between the Indian and Chinese per-capita GDPs in 2015 is 30 percent in China's stable-growth scenario, and 45 percent in its disrupted-growth scenario. The per-capita GDP figures are based on population estimates for 1994 and the assumed population growth rates shown in Table 2.

The per-capita GDP figures shown in Table 3 are derived from the GDP estimates in Tables 1 and the population estimates in Table 2.

The Table 3 data are displayed graphically in Figure 2.

Table 2

1994 Populations and 1994–2015 Population Growth Rates of Selected Countries

Country	1994 Population (millions)	Growth Rate 1994–2015 (%/yr.)
United States	261	.98
Japan	125	.25
China	1,193	.79
Korea	68	1.45
Taiwan	21	.95
India	899	1.76

Table 3

Per-Capita GDPs of the United States and Selected Countries (in thousands of ppp 1994 dollars)

Country	1994	2000	2006	2015
United States	25.7	28.2	30.3	33.2
Japan	20.7	24.4	28.3	34.3
China (1)	4.2	5.3	6.7	9.6
China (2)	4.1	4.6	5.3	6.4
Korea	6.0	10.6	15.0	21.7
Taiwan	13.6	16.6	23.0	33.6
India	1.3	1.7	2.1	2.9

MILITARY SPENDING

The military spending estimates for the six countries are recursively derived from the GDP figures for each country. The derivation ap plies a parameter, γ, representing the expected share of GDP devoted to military spending in each country. This parameter is estimated from recent experience in each country and combined with judgments about expected changes in its value in the next two decades.[3]

For the United States, the value of γ is based on the *Economic Report of the President, 1994*, which anticipates a reduction in the military spending share of GDP from 4 percent to 3 percent by 1998, a share we assume will continue through 2015.

For Japan, two different cases are assumed. In one case, the military spending share of GDP is set at 1 percent, which has been Japan's standard budgetary practice in recent years. In the second case, the share is set at 3 percent to allow for circumstances in which Japan might increase its military allocations in response to, or anticipation of, security developments in the region. Implicitly, we assume that, if Japan were to raise its military spending, the increases would be realized at the expense of consumption rather than investment; hence, GDP growth would not be affected.

[3]For further discussion of the parameter values assumed for each country, see the appendix.

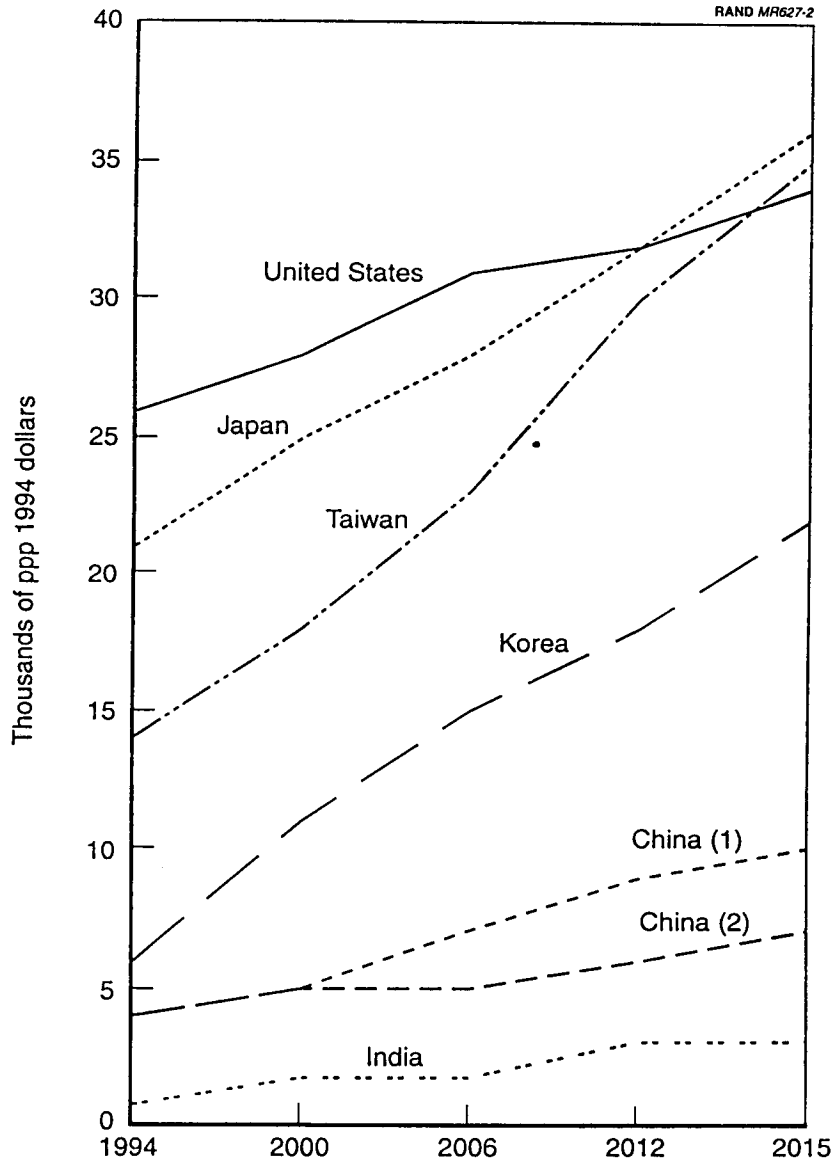


Figure 2—Per-Capita GDPs of the United States and Selected Countries

For China, the military spending share ranges between 3 percent and 3.5 percent in the stable-growth scenario, and remains at 3 percent in the disrupted-growth case.[4] This military spending share reflects our judgment that several additions to the official figures are warranted: first, added funding that is provided to the military but is included in other ministerial budgets than that of the military; second, part of the proceeds from foreign military sales redound to the military establishment; and third, net revenues from civilian commercial sales by industries controlled by the defense establishment also accrue in part to the military establishment.

On these assumptions, China's military spending begins to exceed that of the United States early in the first decade of the 21st century in China's stable-growth scenario, while remaining well below that of the United States in the disrupted-growth scenario.

Japan's military spending remains substantially below that of the United States, for both the 3 percent and 1 percent military spending scenarios.

For Taiwan, the military spending share is set at 5 percent of GDP, for Korea at 4 percent, and for India between 3.5 percent and 4 percent over the 1994–2015 period.

Taiwan's military spending, currently about 7 percent of that of China, rises slightly relative to that of China by 2015.

Korea's military spending, which is currently somewhat below that of Japan ($21 billion versus $26 billion for Japan), exceeds Japan's military spending by the year 2000 and thereafter in the scenario in which Japan's military spending share is 1 percent. Korea's military spending remains below that of Japan if Japan's military spending share increases to 3 percent of its GDP. India's military spending, about $42 billion in 1994, reaches a regionally significant scale of $148 billion by 2015, which represents 41 percent of China's military spending level in China's disrupted-growth scenario, and about 23 percent of China's higher military spending level in the stable-growth scenario.

[4]These shares are considerably higher (by a factor of 2) than China's official estimates. The reasons for our estimates are explained more fully in the appendix.

The military spending forecasts are summarized in Table 4 and Figure 3.

MILITARY CAPITAL STOCKS

As noted earlier, the military capital estimates presented here have been built up recursively, starting with pre-1994 estimates contained in our prior work.[5] The pre-1994 estimates have been adjusted in several ways: to reflect the later Penn World Table ppp figures,[6] to shift the base year from 1986 to 1994, to add the capital stock increments from 1994 based on the specified military procurement and construction share of annual military spending, and to allow for depreciation of the previously accumulated capital stock.

The new military capital stock estimates are derived by applying a parameter, π, to the annual military spending estimates, represent-

Table 4

Military Spending Estimates
(in billions of ppp 1994 dollars)

Country	1994	2000	2006	2015
United States	290	235	267	322
Japan (1)	26	31	36	45
Japan (2)	78[a]	93	109	135
China (1)	149	215	308	475
China (2)	149	174	208	271
Korea (1)	20	32	49	81
Korea (2)	20	31	49	81
Korea (3)	20	29	49	80
Taiwan	14	20	27	43
India	42	67	93	148

[a]The $78 billion figure is what military spending would have been if 3 percent of the Japanese GDP had been devoted to defense, rather than 1 percent.

[5]See Wolf et al., 1989, especially pp. 32–34. In this study, military capital estimates were made for the period from 1950 to 1985, expressed in 1986 dollars.

[6]Summers and Heston, 1991.

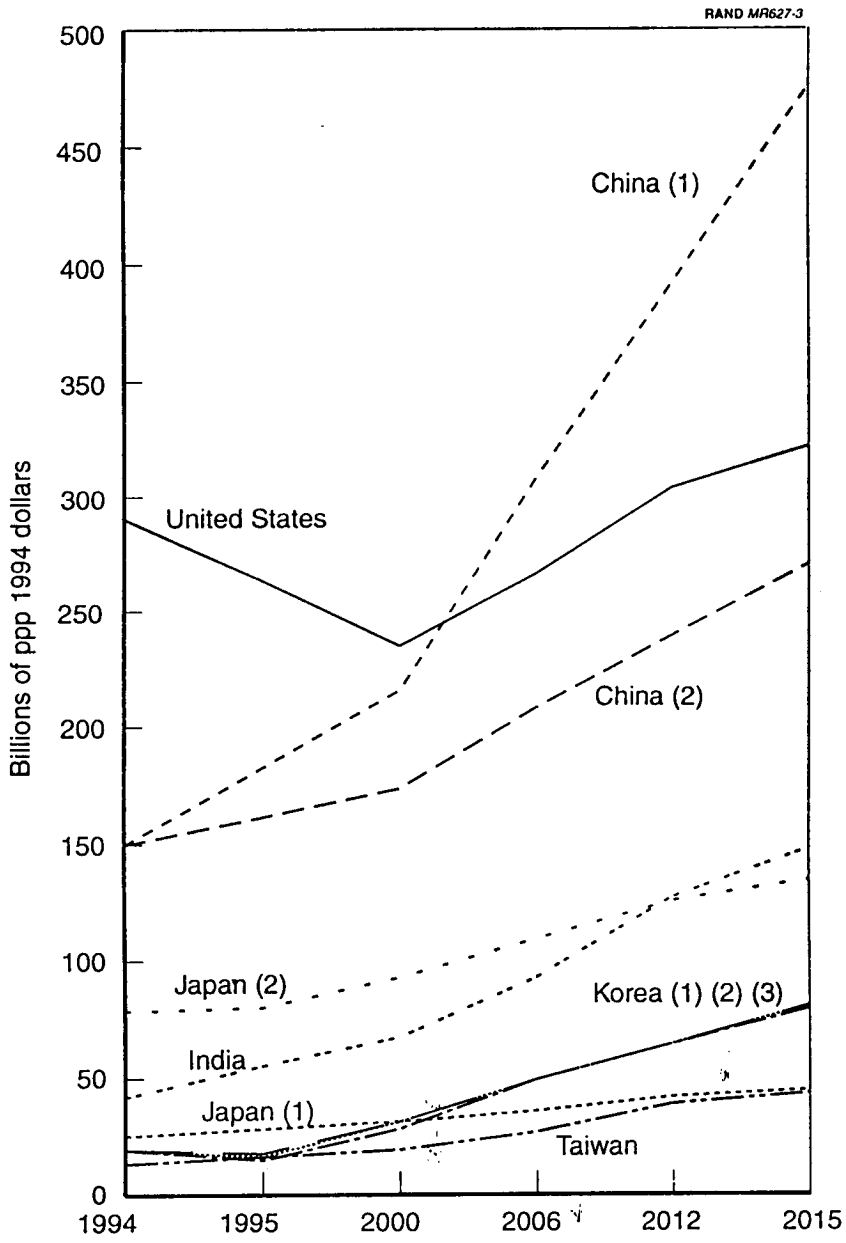


Figure 3—Military Spending Estimates

ing the share of military spending devoted to procurement of military equipment and construction, minus an annual depreciation rate, δ, applied to the previously accumulated capital stock figures. The respective values of π (the military capital share of military spending) and δ (the depreciation rate) are based on recent experience combined with assumptions and judgments about the corresponding values in the future.[7] The values for the capital share, π, vary between 23 percent and 30 percent for the six countries, and their respective annual depreciation rates, δ, vary between 3.5 percent and 6 percent.

The fact that some weapons are imported, rather than domestically produced, introduces another source of imprecision in the military capital stock estimates. The magnitude and direction of this imprecision depends on several complex factors that are not addressed in this study: for example, the gap between nominal and real (i.e., ppp) exchange rates, the extent to which weapons imports are purchased with foreign exchange earned from weapons exports, whether weapons imports are funded by "off-budget" appropriations, and so on.

For the United States, the value of military capital falls over the 1994–2015 period, because additions to U.S. military capital stocks, through procurement and construction, are less than the depreciation of previously accumulated stocks.

Consequently, the military capital stock of $1.1 trillion in 1994 is estimated to fall to about $840 billion by 2015, rising slightly from its nadir in 2011.

Japan's military capital stock rises from 9 percent of that of the United States in 1994 to nearly 20 percent in 2015 in Japan's 1 percent military spending scenario, and to just over half the size of the U.S. military capital stock by 2015 in Japan's 3 percent military spending scenario.

Korea's military capital in 2015 remains about 80 percent of Japan's in the latter's 1 percent military spending scenario, while decreasing sharply in relative terms if Japan raises its military spending to 3 percent of GDP.

China's military capital becomes hugely dominant in the Asia-Pacific region, reaching about 55 percent of the U.S. level in 2015, in China's stable-growth scenario ($456 billion for China compared with $844 billion for the United States in that year). In the disrupted-growth scenario, China's military capital is about 37 percent of that of the United States in 2015.

Taiwan's military capital increases modestly relative to that of China. India's military capital rises appreciably relative to that of China, reaching by 2015 a level of about 77 percent of China's military capital in the stable-growth scenario, and slightly exceeding that of China's in the disrupted-growth scenario ($333 billion military capital for India in 2015 compared with $313 billion for China).

The military capital stock figures are summarized in Table 5 and Figure 4.

Table 5

Military Capital Stocks of the United States and Selected Countries (in billions of ppp 1994 dollars)

Country	1994	2000	2006	2015
United States	1,103	961	858	844
Japan (1)	101	106	127	163
Japan (2)	101	199	293	433
China (1)	202	232	291	456
China (2)	202	219	249	313
Korea (1)	72	68	83	129
Korea (2)	72	67	82	128
Korea (3)	72	43	66	119
Taiwan	30	46	63	101
India	79	126	192	333

[7]For further discussion of the parameter values for π and δ, see the appendix to this report.